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Previous Mental Disorders and Subsequent Onset of Chronic Back or Neck Pain: Findings From 19 Countries

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Abstract: **Associations between depression/anxiety and pain are well established, but its directionality is not clear. We examined the associations between temporally previous mental disorders and subsequent self-reported chronic back/neck pain onset, and investigated the variation in the strength of associations according to timing of events during the life course, and according to gender. Data were from population-based household surveys conducted in 19 countries (N = 52,095). Lifetime prevalence and age of onset of 16 mental disorders according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, and the occurrence and age of onset of back/neck pain were assessed using the Composite International Diagnostic Interview. Survival analyses estimated the associations between first onset of mental disorders and subsequent back/neck pain onset. All mental disorders were positively associated with back/neck pain in bivariate analyses; most (12 of 16) remained so after adjusting for psychiatric comorbidity, with a clear dose-response relationship between number of mental disorders and subsequent pain. Early-onset disorders were stronger predictors of pain; when adjusting for psychiatric comorbidity, this remained the case for depression/dysthymia. No gender differences were observed. In conclusion, individuals with mental disorder, beyond depression and anxiety, are at higher risk of developing subsequent back/neck pain, stressing the importance of early detection of mental disorders, and highlight the need of assessing back/neck pain in mental health clinical settings.**

Perspective: ***Previous mental disorders according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition are positively associated with subsequent back/neck pain onset, with a clear dose-response relationship between number of mental disorders and subsequent pain. Earlier-onset mental disorders are stronger predictors of subsequent pain onset, compared with later-onset disorders.***

Key words: *Back or neck pain, mental-physical comorbidity, psychiatric epidemiology, cross-national studies, mental health.*

Back and neck pain are among the most common pain conditions in the general population,[24,25,55] being, respectively, the leading and the fourth cause of years lost due to disability worldwide.[55] Twelve-month prevalence estimates of back pain range between 12 and 56%,[11,12,35,37,41,53] and of neck pain, from 12 to 34%[3,12,30]; co-occurrence is frequent.[9] Furthermore, back/neck pain is often associated with other pain conditions, physical diseases, and mental disorders.[2,5,8,10,22,23,45,53]

Comorbidity of back/neck pain with depression has been widely reported,[15,17,29] but with other mental disorders it has been less studied. Only more recently, associations with anxiety and comorbid anxiety/alcohol-related disorders have been reported.[42,53] Population-based estimates from 18 countries participating in the World Mental Health (WMH) surveys[12] reported 12-month prevalence of chronic back/neck pain ranging from 10 to 42%, and positive associations with mental disorders were found, across developed as well as developing countries. However, the investigation of such associations did not take into account the temporal sequence of events, leaving it unclear whether mental disorders precede or follow the development of chronic back/neck pain, or both.

Prospective studies examining such association in the general population are less common, and mostly assessed only depression or special populations. Studies from clinical samples typically focused on identifying determinants of transition from acute to chronic pain or addressed the effect of mental disorders on pain prognosis. In a systematic review of 20 prospective studies evaluating 10,842 patients with acute low back pain, the

presence of psychiatric comorbidities were among the most important predictors of persistence of disabling pain.[7] Increased risk of chronicity, with persisting pain and disability, was also associated with psychological factors, such as distress, depressive mood, and somatization.[38] Among primary care patients with acute low back pain, depression was reported to be a significant baseline predictor for persistence of pain in a 6-month follow-up period.[31] A bidirectional association between depressive symptoms and chronic back/neck pain was reported in a 2-year follow-up study of elderly individuals living in the community,[32] with similar results observed in the English Longitudinal Study of Ageing.[6]

Our study used the cross-national WMH surveys data set[28] to assess the presence and extent of the associations between a wide range of common mental disorders and back/neck pain in population-based samples from 19 countries. Although the WMH surveys are cross-sectional in design, systematic information on the timing of onset of these conditions was collected, allowing the use of survival analysis methods to examine associations between temporally previous Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) psychiatric disorders and subsequent onset of back/neck pain. Furthermore, we investigated the effect of psychiatric comorbidity in modifying the risk of subsequent pain onset, and whether there is variation in risk magnitude according to gender or over the life span (ie, whether the age of onset (AOO) of mental disorders modifies the risk of subsequent pain onset).

Methods

Samples and Procedures

This report is on the basis of data obtained from 19 participating countries of the WMH community-based epidemiological surveys that assessed the occurrence of chronic back/neck pain and its AOO (Table 1). Stratified multistage clustered area probability sampling strategies were used to select adult (18 years of age or older) household respondents in most of the participating countries (Belgium, Israel, and Japan used a national registry for 1-stage sampling). All surveys were on the basis of multistage, clustered-area probability household resident samples that were nationally representative, with the exception of 2 samples of only urban areas (Colombia, Mexico) and 1 of a specific metropolitan area (People's Republic of China, Shenzhen). Sample sizes ranged from 2,357 (Romania) to 12,790 (New Zealand), with a total of 98,714 participating adult respondents (Table 1). Response rates ranged from 45.9% (France) to

Table 1. Characteristics of WMH Samples and Percent (and Number) With History of Chronic Back or Neck Pain

			Sample Size, N		Response Rate, %	History of Chronic Back or Neck Pain	
Country	Data Collection	Age Range, Years	Part 1	Part 2 Subsample		Number Unweighted, n	Weighted Prevalence, %
Americas							
Colombia	2003	18 to 65	4,426	2,381	87.7	516	17.3
Mexico	2001-2002	18 to 65	5,782	2,362	76.6	682	23.6
Peru	2005-2006	18 to 65	3,930	1,801	90.2	201	9.7
United States	2002-2003	≥18	9,282	5,692	70.9	1,905	29.3
Asia and South Pacific							
PRC* Shenzhen	2006-2007	≥18	7,132	2,475	80.0	555	14.8
Japan	2002-2006	≥20	4,129	1,682	55.1	501	25.3
New Zealand	2003-2004	≥18	12,790	7,312	73.3	2,463	30.2
Europe							
Belgium	2001-2002	≥18	2,419	1,043	50.6	368	31.0
France	2001-2002	≥18	2,894	1,436	45.9	586	38.2
Germany	2002-2003	≥18	3,555	1,323	57.8	395	28.5
Italy	2001-2002	≥18	4,712	1,779	71.3	947	50.5
The Netherlands	2002-2003	≥18	2,372	1,094	56.4	329	24.2
Northern Ireland	2004-2007	≥18	4,340	1,986	68.4	435	21.3
Poland	2010-2011	18 to 64	10,081	4,000	50.4	888	18.8
Portugal	2008-2009	≥18	3,849	2,060	57.3	542	22.4
Romania	2005-2006	≥18	2,357	2,357	70.9	550	20.7
Spain	2001-2002	≥18	5,473	2,121	78.6	641	23.7
Middle East							
Iraq	2006-2007	≥18	4,332	4,332	95.2	860	18.2
Israel	2002-2004	≥21	4,859	4,859	72.6	1,245	25.1
Weighted average response rate, %					67.4		
Total sample size			98,714	52,095		14,609	24.7

*People's Republic of China.

95.2% (Iraq), with a weighted average of 78% (Table 1). Weights were used to adjust for differential probabilities of selection within all sampling stages, to nonresponse and to match samples with population demographic distributions in all countries. Detailed information about WMH sampling and weighting procedures is presented elsewhere.[21]

All respondents were assessed in their homes with face-to-face interviews using the WMH Surveys version of the Composite International Diagnostic Interview (CIDI 3.0)[27] by trained nonclinical interviewers. Standardized World Health Organization translation, back-translation, and harmonization procedures were used to translate and adapt the instruments and other study materials into the different languages used in the surveys, so as to maximize comparability of assessments across countries.[18]

In most surveys, random subsampling was used, depending on allocation and availability of resources, to reduce respondent burden and average interviewing time. Within this framework, the CIDI 3.0, comprised of clinical and nonclinical sections, was arranged in part 1 and part 2. All respondents received part 1, and those who met lifetime diagnostic criteria (according to the DSM-IV and International Classification of Diseases, 10th Revision) for any of the core disorders assessed in part 1 (mood, anxiety, substance use, and impulse control disorders, as well as suicidal cognitions and behavior) and a probability sample of noncases were administered and part 2, which is comprised of sections assessing risk factors, additional less common mental disorders (eg, obsessive compulsive, post-traumatic stress, and eating disorders), use of services, and physical conditions. Part 2 respondents were additionally weighted by the inverse of their probability of selection for part 2 of the interview, thus adjusting for differential sampling. Analyses in this report are on the basis of the weighted part 2 subsample, which was comprised of 52,095 respondents.

Consistent field quality control procedures, described in detail elsewhere,[36] were implemented in all countries. Interviews were conducted after informed consent was given by respondents. All surveys were carried out strictly in compliance with procedures approved by local institutional review boards or ethical committees.

Measures

Mental Disorders

All surveys used the WMH survey version of the previously mentioned World Health Organization CIDI (now CIDI 3.0),[27] a fully structured interview, developed to assess lifetime history of mental disorders, on the basis of the DSM-IV definitions and criteria. A total of 16 mental disorders were assessed, including anxiety disorders (panic disorder, agoraphobia without panic, specific phobia, social phobia, post-traumatic stress disorder, generalized anxiety disorder [GAD], obsessive compulsive disorder), mood disorders (major depressive disorder/dysthymia, and bipolar disorders I and II), substance use disorders (alcohol and drug abuse and dependence), and impulse control disorders (intermittent explosive disorder, bulimia nervosa, and binge-eating disorder). CIDI organic exclusion rules were applied in making diagnoses. Clinical reappraisal studies conducted in some of the WMH countries indicate that lifetime diagnoses of anxiety, mood, and substance use disorders on the basis of the CIDI have generally good concordance with diagnoses on the basis of blinded clinical interviews.[19]

Chronic Back or Neck Pain Status

In a series of questions about physical health, adapted from the U.S Health Interview Survey,[33] respondents were asked about the lifetime presence of selected chronic conditions. For the ascertainment of chronic back/neck pain, respondents were asked if they ever had serious chronic back/neck pain. Although all studies on chronic pain are reliant on self-assessment and self-reporting of symptoms and their intensity, as well as its AOO, in an attempt to reduce information and recall biases and improve the quality of data collected, the question was carefully worded: "Serious chronic pain is defined as pain lasting six months or longer that is severe enough either to interfere with your normal activities or to cause emotional distress. With that definition in mind, did you have serious chronic pain in the past 12 months in the neck/back region?"; if this was endorsed, they were further encouraged to best estimate the first AOO of the condition). One major concern in self-reporting AOO is the occurrence of telescoping bias, which was explored through the analyses of AOO distributions across age cohorts, and there were not significant differences in reporting early-onset chronic back/neck pain across age cohorts (data available on request). Therefore, if respondents endorsed having had the condition, they were classified as having a history of chronic back/neck pain and the AOO was used to create the person-year data set.

Statistical Analysis

Discrete time survival analyses[47] with person-year as the unit of analysis were used to test sequential associations between first onset of mental disorders and the subsequent onset of chronic back/neck pain. For these analyses, a person-year data set was created in which each year in the life of each respondent up to and including the AOO of chronic back/neck pain or their age at interview (whichever came first) was treated as a separate observational record, with the year of chronic back/neck pain onset coded 1 and earlier years coded 0, on a dichotomous outcome variable. Mental disorder predictors were coded 1 from the year after first onset of each individual mental disorder. This time lag of 1 year in the coding of the predictors ensured that in cases in which the first onset of a mental disorder and of chronic back/neck pain occurred in the same year, the mental disorder would not count as a predictor. Only person-years up to the diagnosis of chronic back/neck pain were analyzed, so that only mental disorder episodes occurring before the onset of chronic back/neck pain were included in the predictor set. Logistic regression was used to analyze these

data with the survival coefficients presented as odds ratios (ORs), indicating the relative odds of chronic back/neck pain onset in a given year for a person with a history of mental disorder compared with a person without that mental disorder, or without any history of mental disorder.

A series of bivariate and multivariate models were developed, including the "predictor" mental disorder plus control variables. Bivariate models investigated association of specific mental disorders with subsequent onset of chronic back/neck pain, in which only 1 mental disorder at a time was considered as a predictor of chronic back/neck pain onset, each disorder in a separate discrete time survival model controlling for age-cohort, gender, person-year, and country. The next model, a multivariate model, estimated the associations of each mental disorder with chronic back/neck pain onset, adjusting also for mental disorder comorbidity (that is, for other mental disorders occurring at any stage before the onset of chronic back/neck pain), with all mental disorders considered simultaneously in the model. A second multivariate model included a series of predictor variables for number of mental disorders (eg, one such variable for respondents who experienced exactly 1 mental disorder, another for respondents who experienced exactly 2 mental disorders, and so on), as well as the control variables. Other more complex nonadditive multivariate models were also run, for example, including type as well as number of mental disorders, but model fit statistics did not indicate these provided a better fit for the data, so the simpler models are reported (model fitting statistics are available on request). Our general approach was to not control for covariates that could be on the causal pathway between mental disorders and subsequent chronic back/neck pain.

We examined life course variation in 2 ways. First, we examined whether early- versus late-onset mental disorders differed significantly in their associations with chronic back/neck pain through creation of mental disorder-specific dummy variables for early-onset mental disorder (21 years of age or younger) and late-onset disorder (older than 21 years; see each table's footnotes for model specifications). Second, we assessed whether associations varied according to when in the life course chronic back/neck pain started by including cross-product terms between person-years (coded as a continuous variable) and each type of mental disorder in the multivariate type model. Gender differences were examined by including cross-product terms between gender and each mental disorder in the multivariate type model.

Our earlier studies of concurrent mental-physical comorbidity in the WMH surveys found that their associations are generally consistent cross-nationally, despite varying prevalence of mental disorder and physical conditions.[12,54] All analyses for this report were therefore run on the pooled cross-national data set. Because the WMH Surveys data are clustered as well as weighted, the design-based Taylor series linearization[44] implemented in version 10 of the SUDAAN software system[49] was used to estimate standard errors and evaluate the statistical significance of coefficients.

Results

Sample Characteristics and History of Chronic Back or Neck Pain

Characteristics of the WMH samples and history of chronic back/neck pain are presented in Table 1. A total of 52,095 respondents (part 2 subsample) were included in the analyses. From those, 14,609 respondents reported history of chronic back/neck pain, with a global prevalence of 24.7%. Although the prevalence range across countries was quite wide, from 9.7% in Peru to 50.5% in Italy, chronic back/neck pain was reported by one-fifth to one-third of the population in most countries (Table 1).

Previous Mental Disorders and Subsequent Onset of Chronic Back or Neck Pain

All mental disorders assessed were positively associated with subsequent onset of chronic back/neck pain (Table 2) in bivariate models, with ORs ranging from 1.7 for alcohol abuse to 2.9 for bulimia nervosa.

Considering that comorbidity among lifetime mental disorders may play a role in the associations with chronic back/neck pain onset, the results of multivariate models are shown in the second data column of Table 2. It can be seen that, although the magnitude of the associations diminished, most disorders remained significantly associated with subsequent onset of chronic back/neck pain, with ORs ranging between 1.3 and 1.6 (Table 2); only bipolar disorder, agoraphobia without panic, and alcohol and drug dependence (ie, 4 of 16 disorders assessed) was not associated with subsequent pain in this model. The global χ^2 value for testing the joint effect of all types of mental disorders was large and highly significant ($\chi_{16} = 934.2$; $P \leq .001$). Moreover, the test for variation in the ORs was also significant ($\chi_{15} = 67.3$; $P \leq .001$), indicating that the hypothesis that the ORs are the same for all disorders should be rejected, supporting the interpretation that those mental disorders remaining significant have specific associations with pain onset, rather than expressing just a global effect of emotional distress.

The next multivariate model considered the number of mental disorders, regardless of their type, with results presented in the last column of Table 2. There is a clear dose-response relationship in the association between the number of mental disorders experienced and subsequent onset of chronic back/neck pain, with ORs for pain of 1.8 in respondents with 1 mental disorder, increasing to 3.2 among those with ≥5 lifetime mental disorders (Table 2). The global χ^2 test for the joint effect of the number of mental disorders was large and highly significant ($\chi_5 = 760.3$; $P \leq .001$).

Timing of Mental Disorder Onset (Early Vs Late Onset)

We investigated whether early-onset mental disorders (defined as having first onset occurring before the

Table 2. Bivariate and Multivariate Associations (ORs) Between Lifetime DSM-IV Mental Disorders and the Subsequent Onset of Chronic Back or Neck Pain (N = 52,095)

	Bivariate Models‡		Multivariate Type Model§		Multivariate Number Model‖	
Mental Disorders†	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
I. Mood disorders						
Major depressive episode/ dysthymia	1.8*	(1.7–1.9)	1.4*	(1.3–1.5)	-	-
Bipolar disorder (broad)	2.1*	(1.8–2.4)	1.1	(1.0–1.4)	-	-
II. Anxiety disorders						
Panic disorder	2.1*	(1.8–2.3)	1.3*	(1.1–1.4)	-	-
GAD	2.2*	(2.0–2.4)	1.4*	(1.3–1.6)	-	-
Social phobia	1.9*	(1.7–2.0)	1.3*	(1.1–1.4)	-	-
Specific phobia	1.8*	(1.7–2.0)	1.5*	(1.4–1.6)	-	-
Agoraphobia without Panic	1.8*	(1.5–2.2)	1.0	(.8–1.3)	-	-
Post-traumatic stress disorder	2.0*	(1.7–2.2)	1.3*	(1.1–1.4)	-	-
Obsessive compulsive disorder	1.9*	(1.5–2.5)	1.4*	(1.1–1.8)	-	-
III. Impulse control disorders						
Intermittent explosive disorder	2.2*	(1.9–2.5)	1.5*	(1.3–1.7)	-	-
Binge eating disorder	2.1*	(1.6–2.8)	1.5*	(1.1–2.0)	-	-
Bulimia nervosa	2.9*	(2.2–3.7)	1.6*	(1.2–2.1)	-	-
IV. Substance disorders						
Alcohol abuse	1.7*	(1.6–1.9)	1.3*	(1.2–1.5)	-	-
Alcohol dependence with abuse	2.0*	(1.7–2.3)	1.0	(.9–1.2)	-	-
Drug abuse	2.2*	(1.9–2.5)	1.4*	(1.2–1.6)	-	-
Drug dependence with abuse	2.1*	(1.7–2.6)	.8	(.6–1.0)	-	-
Joint effect of all types of disorders, χ^2_{16}				934.2*		
Difference between types of disorders, χ^2_{15}				67.3*		
V. Number of disorders						
None (reference)					1.0	
Exactly 1 disorder	-	-	-	-	1.8*	(1.7–2.0)
Exactly 2 disorders	-	-	-	-	2.2*	(2.0–2.4)
Exactly 3 disorders	-	-	-	-	2.5*	(2.2–2.8)
Exactly 4 disorders	-	-	-	-	2.5*	(2.2–2.9)
5 or more disorders	-	-	-	-	3.2*	(2.7–3.7)
Joint effect of number of disorders, χ^2_5						760.3*

Abbreviation: CI, confidence interval.
*Significant at the .05 level, 2-tailed test.
†The reference category for all disorders is the absence of each diagnosis.
‡Each mental disorder type was estimated as a predictor of the physical condition onset in a separate discrete time survival model controlling for age cohorts, gender, person-year, and country.
§The model was estimated with dummy variables for all mental disorders entered simultaneously, including the controls specified above.
‖The model was estimated with dummy predictors for number of mental disorders without any information about type of mental disorders, including the controls specified above.

age of 21) were more or less strongly associated with onset of chronic back/neck pain compared with later-onset mental disorders (Table 3). Results from the bivariate models, in which early-onset and late-onset variants of each mental disorder were both included in the model as predictors of subsequent onset of chronic back/neck pain, with the usual control variables but with no adjustment for other mental disorders are presented in the first 2 columns of data in Table 3. Most (12 of 16) early-onset mental disorders showed quantitatively larger associations with subsequent chronic back/neck pain compared with their later-onset equivalents. When formally tested, the differences (early- vs later-onset ORs) were significant for depression/dysthymia, bipolar disorder, panic disorder, GAD, post-traumatic stress disorder, alcohol abuse, and alcohol dependence. The magnitude of ORs for early-onset mental disorders leading to subsequent pain ranged from 1.8 for obsessive compulsive disorder to 2.6 for GAD and 2.8 for bulimia. For later-onset mental disorders, ORs ranged from 1.5 for all mood disorders, social phobia, and alcohol abuse, to 3.2 for bulimia (Table 3).

In the multivariate models (second set of columns in Table 3), when accounting for comorbid mental disorders, the only significant difference was for depression/dysthymia, because early-onset depression (ORs = 1.5; 95% confidence interval = 1.3–1.5) was more strongly associated with subsequent pain onset compared with later-onset depression (ORs = 1.3; 95% confidence interval = 1.2–1.4). Although variation in the timing of onset of the mental disorder evaluated does significantly affect the strength of association with subsequent chronic back/neck pain onset, most of the associations disappeared when accounting for comorbid mental disorders, because

Table 3. Associations (ORs) Between Early Versus Late Mental Disorder Onset and the Subsequent Onset of Chronic Back or Neck Pain

	Bivariate Models†				Multivariate Model‡			
	Early	Late	Test of the Difference Between Early and Late		Early	Late	Test of the Difference Between Early and Late	
	OR (95% CI)	OR (95% CI)	x1‡	P	OR (95% CI)	OR (95% CI)	x1‡	P
I. Mood disorders								
Major depressive episode/dysthymia	2.2* (2.0–2.4)	1.5* (1.4–1.7)	31.8*	.000	1.5* (1.3–1.6)	1.3* (1.2–1.4)	4.6*	.032
Bipolar disorder (broad)	2.5* (2.1–3.0)	1.5* (1.2–2.0)	8.3*	.004	1.2 (1.0–1.5)	.9 (.7–1.2)	3.0	.085
II. Anxiety disorders								
Panic disorder	2.4* (2.0–2.8)	1.7* (1.4–2.0)	7.2*	.007	1.3* (1.1–1.6)	1.2 (.9–1.4)	.9	.358
GAD	2.6* (2.3–3.0)	1.8* (1.6–2.1)	15.4*	.000	1.5* (1.3–1.7)	1.3* (1.2–1.5)	1.6	.213
Social phobia	1.9* (1.8–2.1)	1.5* (1.1–2.0)	2.9	.090	1.3* (1.1–1.4)	1.0 (.7–1.4)	1.6	.203
Specific phobia	1.9* (1.7–2.0)	1.4 (1.0–1.9)	3.2	.075	1.5* (1.4–1.7)	1.2 (.8–1.7)	1.7	.197
Agoraphobia without panic disorder	1.9* (1.5–2.4)	1.4 (1.0–2.0)	2.4	.125	1.0 (.8–1.3)	.9 (.6–1.3)	.4	.544
Post-traumatic stress disorder	2.2* (1.9–2.6)	1.6* (1.3–2.1)	4.9*	.028	1.3* (1.2–1.6)	1.2 (1.0–1.5)	.8	.372
Obsessive compulsive disorder	1.8* (1.4–2.5)	2.3* (1.3–4.3)	.4	.549	1.4* (1.0–1.8)	1.6 (.9–3.0)	.2	.642
III. Impulse-control disorders								
Intermittent explosive disorder	2.3* (2.0–2.6)	1.8* (1.3–2.6)	1.6	.210	1.5* (1.3–1.8)	1.3 (.9–1.9)	.4	.525
Binge eating disorder	1.9* (1.4–2.7)	2.4* (1.5–3.9)	.5	.467	1.4 (1.0–1.9)	1.6 (1.0–2.7)	.3	.620
Bulimia nervosa	2.8* (2.1–3.7)	3.2* (2.0–5.1)	.3	.598	1.4* (1.0–2.0)	2.0* (1.2–3.3)	1.0	.317
IV. Substance disorders								
Alcohol abuse	1.9* (1.7–2.2)	1.5* (1.3–1.7)	10.1*	.002	1.4* (1.2–1.7)	1.2* (1.0–1.4)	2.7	.102
Alcohol dependence with abuse	2.3* (1.9–2.7)	1.6* (1.3–2.1)	5.1*	.023	1.1 (.9–1.3)	1.0 (.8–1.3)	.3	.612
Drug abuse	2.1* (1.8–2.5)	2.2* (1.7–2.9)	.0	.896	1.3* (1.0–1.6)	1.4* (1.1–1.9)	.4	.521
Drug dependence with abuse	2.2* (1.7–2.8)	2.0* (1.3–3.0)	.2	.660	.7 (.5–1.0)	.8 (.5–1.3)	.2	.651
V. Joint effect of all early onset disorders, χ^2_{16}					746.2*			
VI. Joint effect of all late onset disorders, χ^2_{16}						122.3*		
VII. Joint effect of early onset disorders independent of joint effect of any disorders, χ^2_{16}							30.8*	

Abbreviation: CI, confidence interval.
*Significant at the .05 level, 2-tailed test.
†Models include dummy variables for early-onset mental disorders (first onset at younger than 21 years of age) and for late-onset disorders, plus control variables (age cohort, person-years, gender, and country). A second bivariate model was estimated to test the significance of the difference between early- and late-onset disorders. This model included the dummy variables for the early-onset disorder and the dummy variable for the disorder itself (ie, having it at all), plus controls.
‡Multivariate models paralleled the bivariate models in design but included dummy variables for all mental disorders entered simultaneously.

the earlier the onset of mental disorders, the greater the occurrence of lifetime comorbidity. Taken together, the joint effect of all early-onset mental disorders was large and highly significant ($\chi_{16} = 746.2$; $P \leq .001$), and larger than the joint effect of the later-onset disorders ($\chi_{16} = 122.3$; $P \leq .001$).

Variation Across the Life Course Regarding Timing of Chronic Back or Neck Pain Onset

To examine whether there were variations in the associations between mental disorders and pain onset, as

Table 4. Variations in Associations Between Mental Disorders and Chronic Back or Neck Pain According to Life Course Timing of Chronic Back or Neck Pain Onset

	Mental Disorder × Person-Year Interaction†			Stratified Models According to Age in Years‡			
				Up to Age 24	Age 25 to 35	Age 36 to 47	Age Older Than 48
Type of Mental Disorder	OR (95% CI)	x^2†	P	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Major depressive episode/ dysthymia	.98* (.98–.98)	87.7*	.000	1.8* (1.6–2.0)	1.4* (1.2–1.5)	1.3* (1.2–1.5)	1.3* (1.1–1.5)
Bipolar disorder (broad)	.98* (.97–.99)	11.8*	.001	1.3* (1.0–1.7)	1.0 (.7–1.4)	1.0 (.6–1.4)	1.5 (.9–2.4)
Panic disorder	.97* (.96–.98)	37.3*	.000	1.4* (1.1–1.8)	1.5* (1.2–1.9)	1.2 (.9–1.5)	.9 (.6–1.3)
GAD	.98* (.97–.99)	23.5*	.000	1.4* (1.1–1.7)	1.2* (1.0–1.5)	1.7* (1.4–2.1)	1.5* (1.2–1.9)
Social phobia	.98* (.97–.98)	68.4*	.000	1.3* (1.1–1.5)	1.3* (1.1–1.5)	1.0 (.9–1.3)	.9 (.7–1.2)
Specific phobia	.99* (.99–1.00)	16.4*	.000	1.4* (1.3–1.6)	1.5* (1.3–1.7)	1.5* (1.3–1.7)	1.5* (1.2–1.9)
Post-traumatic stress disorder	.98* (.97–.99)	21.6*	.000	1.2 (1.0–1.5)	1.4* (1.1–1.8)	1.3* (1.0–1.7)	1.2 (.9–1.6)
Intermittent explosive disorder	.99* (.97–1.00)	7.8*	.005	1.5* (1.2–1.9)	1.5* (1.2–1.9)	1.3 (.9–1.8)	1.5 (.9–2.3)
Alcohol abuse	.97* (.96–.98)	59.0*	.000	1.4* (1.1–1.7)	1.3* (1.1–1.6)	1.3* (1.0–1.7)	1.0 (.7–1.3)
Alcohol Dependence with Abuse	.98* (.96–.99)	11.7*	.001	1.0 (.8–1.4)	1.0 (.7–1.4)	1.0 (.7–1.4)	1.5 (1.0–2.5)
Drug abuse	.97* (.95–.99)	13.2*	.000	1.3 (1.0–1.8)	1.1 (.8–1.4)	1.7* (1.1–2.4)	2.1* (1.2–3.7)
Drug dependence with abuse	.96* (.93–.98)	11.1*	.001	.8 (.6–1.2)	.9 (.6–1.3)	.6 (.3–1.1)	.2* (.1–.9)

Abbreviation: CI, confidence interval.
*OR significant at the .05 level, 2-sided test.
†A series of multivariate models were estimated. For example, the model for depression included the dummy variables for all mental disorders plus the cross-product term for depression and person-year (as a continuous variable), plus the controls specified for earlier models.
‡The multivariate model was estimated in the 4 person-year data sets corresponding to quartiles of the chronic back or neck pain onset distribution.

a function of when in the life course the chronic back/neck pain onset occurred, we conducted a series of multivariate analyses including an interaction term between person-year and each mental disorder assessed as predictor, adjusting for the occurrence of other mental disorders (Table 4). There were strongly significant negative interactions between all mental disorders and person-year, indicating that the strength of associations do vary according to the timing (age) of pain onset for all mental disorders, shown in the first 3 columns of Table 4. The negative interaction indicates that the younger the AOO of chronic back/neck pain, the stronger the role of mental disorders as determinants of pain occurrence. To better illustrate the nature of these interactions, the person-year data set was then stratified into quartiles according to the AOO of pain and the multivariate models were re-estimated for each quartile. These results, shown in the remainder of Table 4, indicate that associations between most mental disorders and subsequent chronic back/neck pain were stronger when the pain condition occurred earlier rather than later in life. This is illustrated by either the reducing magnitude of the associations or the loss of significance in older-onset cohorts, as seen, for example, in depression/dysthymia (ORs = 1.8 to 1.3, all significant) or in panic disorder (ORs = 1.4 to .9). For a few disorders, this pattern is not evident with the categories applied in the stratified analyses. However, the negative interaction between person-year and these disorders indicates that the general pattern of stronger association with earlier pain onset also holds true for these disorders.

Gender Differences

There were no significant interactions of gender with any of the mental disorders in predicting chronic back/neck pain onset, indicating that associations of mental disorders and the pain condition were similar for men and women (results available on request).

Discussion

Using a large general population-based sample, this study corroborated the assumption that self-reported chronic back/neck pain is a frequent condition, affecting 20 to 30% of the general adult resident population in most countries (ranging from 10–50%). Because of the large number of respondents, the rigorous diagnostic as-

sessment of common mental disorders, and systematic information on AOO of both conditions, this is the first study able to examine the role a wide range of DSM-IV mental disorders may play in increasing the risk of subsequent onset of chronic back/neck pain, and to further adjust for mental disorder comorbidity. Indeed, all mental disorders studied were positively associated with subsequent onset of chronic back/neck pain in bivariate analyses, and, for most (12 of 16), the associations remained significant after adjusting for psychiatric comorbidity, including depression/dysthymia, all anxiety disorders (except agoraphobia), all impulse control disorders, and alcohol and drug abuse. A clear dose-response relationship between the number of mental disorders experienced and the associated risk of subsequent onset of chronic back/neck pain was observed.

When examining the AOO of DSM-IV mental disorders, almost all disorders (with the exception of late-onset specific phobia and agoraphobia) were associated with subsequent pain, regardless of AOO; however, those with early onset were more strongly associated with subsequent pain compared with their later-onset counterparts. When adjusting for psychiatric comorbidity, the differential associations for early versus later onset typically disappeared, because of the more frequent occurrence of psychiatric comorbidity after early-onset psychiatric disorders. The differential association only remained significant for depression/dysthymia, indicating that early-onset depression may create a specific vulnerability to later-onset back pain. Another important novel finding was that the earlier the onset of chronic back/neck pain, the stronger the role of mental disorders as predictors of pain occurrence, for most mental disorders. And finally, although women are more likely to report pain and to suffer from mood and anxiety disorders, there were no gender differences in the associations of mental disorders and subsequent onset of chronic back/neck pain.

Despite the strengths of this study, it is also important to emphasize a number of limitations, which may influence the interpretation of the findings. Retrospective information regarding mental health symptoms, collected in a cross-sectional design, is likely to be susceptible to recall bias, which may result in underestimating diagnosis of psychiatric disorders[56] and/or inaccurate timing estimation of AOO of symptoms.[46] Attempting to reduce recall bias, the CIDI 3.0 version developed to be used in the WMH surveys was modified to improve precision in timing events and AOO of symptoms.[27] The occurrence of chronic back/neck pain was self-reported, on the basis of a limited number of questions on the basis of a stated definition of "serious chronic pain," which might have led to the underestimation of mild pain conditions, because more severe and lasting pain is more likely to be reported.[26] Previous findings have suggested that self-reporting might be less distorted than behavioral pain measures, which are likely to be influenced by cultural and social norms or coping strategies.[20,48] Additionally, self-report methods have been shown to present moderate to high agreement with medical records.[33] However, reporting pain may be influenced by current mood status, especially if respondents are currently depressed.[51] To assess for this potential limitation, we reran the analyses excluding respondents with DSM-IV 30-day major depressive disorder (MDD) and essentially the same results were observed (ie, the associations remained the same regardless of current depressive mood; data available on request). Because back/neck pain are not conditions commonly associated with premature death, it is unlikely that these finding may have been affected by survival bias. However, the most severe and impairing cases were probably not included in the surveys, because they either would not be able to participate in such a complex assessment or may have been admitted into health care facilities; in both cases this would have led to underestimation of the strength of the associations examined. Finally, control for multiple comparisons were not carried out, because its use has been the subject of considerable scientific debate.[40]

These findings, on the basis of the survival analysis framework used in this study, cannot be paralleled by any other single previous report in the literature for several reasons: the range of mental disorders assessed in this study was wider than previous research (which mostly focused on depression and anxiety), and these were ascertained through the systematic investigation of symptoms on the basis of diagnostic criteria; a specific temporal direction of associations was investigated (ie, mental disorders as predictors and chronic back/neck pain as the outcome); the effect of timing of onset of mental disorders in the occurrence of pain, as well as the influence of mental disorders in the timing of pain onset, have never, to our knowledge, been investigated. However, because of the retrospective nature of the data, these findings will require confirmation in prospective designs.

Previous investigation has been mostly devoted to assessing the relationship of pain and major depression, with reports of bidirectional relationships or co-occurrence,[13,16] with, in all cases, worse clinical prognosis, poorer treatment response, and increased disability.[2,43] In this study, depression, examined together with dysthymia, was found to be significantly associated with subsequent onset of back/neck pain, even after controlling for comorbidity with other mental disorders, and regardless of AOO of back/neck pain, not only corroborating previous findings, but establishing novel information. Depression, among all disorders studied and after controlling for psychiatric comorbidity, was the only mental disorder conveying differential magnitude of risk for pain, when occurring early, compared with late onset.

The relation between chronic pain and mental disorders is not easy to disentangle, because there are many mechanisms involved in the pain process, such as interaction in the central nervous system neurotransmitters and receptors, genetic influences, inhibition of pain circuitry, turning the understanding of pain expression and comorbidity extremely complex.[4] Evidence from translational research suggests that the neuroanatomical and functional overlap between pain and emotion/reward/motivation brain circuits support integration and mutual modulation of these systems.[14] Behavior-related mechanisms might also be relevant, because psychiatric conditions are related to being sedentary and poorer diets,

leading to dyslipidemia and obesity, causing inflammation, in turn associated with pain as well as psychiatric morbidity, especially depression.[1,39,50] However, because we found associations with most mental disorders, lifestyle and/or behavior-associated mechanisms may play a generic, nonspecific role across mental disorders. Other lifestyle-related behaviors, such as occupational stress and tobacco smoking, may also contribute to psychoimmune dysfunctions and inflammation.[34] Psychiatric disorders are frequently associated with alterations in pain processing, whereas chronic pain may impair emotional and cognitive functioning.[14] And indeed, beyond depression, we documented that most mental disorders assessed are significantly associated with subsequent chronic back/neck pain onset, with important implications for prevention and care provision. Although there is a robust literature on depression being associated with inflammation, there is less agreement on the causal nature of this association, or if there might be underlying factors causing mental disorders as well as pain.

It is well established that early-onset mental disorders take longer to be diagnosed and treated, often present with greater severity of symptoms, and have generally poorer prognosis and more disabling course.[38,42,43] They are also more likely to be associated with comorbid medical/physical conditions, as well as with other psychiatric disorders later in life.[43] The stronger association of early-onset mental disorders with subsequent pain (compared with later-onset mental disorders) may help explain part of the burden associated with the more pervasive course of early-onset psychiatric conditions. It may also indicate the deleterious role that inflammatory processes associated with more severe mental disorders may pose to physical conditions.[34,39] Moreover, because comorbidity of mental disorders is common, and the number of disorders over the lifetime is a marker of severity of psychopathology, it is of interest that the strength of association with pain increases as the number of disorders experienced increases, as shown by the dose-response relationship found.

Conclusions

The public health importance of chronic back/neck pain is unquestionable.[52,55] Its consequences are vast and affect individuals, families, health care systems, industry, and the economy,[52] attributed to restrictions in physical capabilities, individual participation, work-related and financial burden, and use of health care resources.[52,55] This report points out the great importance of all mental disorders as associated risk factors for subsequent onset of chronic back and neck pain, and these findings should be taken into account to improve early identification and management of mental health disorders and pain symptoms, thereby reducing comorbidity and disability.

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References

1. Au B, Smith KJ, Gariépy G, Schmitz N: The longitudinal associations between C-reactive protein and depressive symptoms: Evidence from the English Longitudinal Study of Ageing (ELSA). Int J Geriatr Psychiatry 30:976-984, 2015

2. Benjamin S, Morris S, McBeth J, Macfarlane GJ, Silman AJ: The association between chronic widespread pain and mental disorder: A population-based study. Arthritis Rheum 43:561-567, 2000

3. Bovim G, Schrader H, Sand T: Neck pain in the general population. Spine 19:1307-1309, 1994

4. Bras M, Dordević V, Gregurek R, Bulajić M: Neurobiological and clinical relationship between psychiatric disorders and chronic pain. Psychiatr Danub 22:221-226, 2010

5. Carroll L, Cassidy JD, Cote P: The Saskatchewan health and back pain survey: The prevalence and factors associated with depressive symptomatology in Saskatchewan adults. Can J Public Health 91:459-464, 2000

6. Chou KL: Reciprocal relationship between pain and depression in older adults: evidence from the English Longitudinal Study of Ageing. J Affect Disord 102:115-123, 2007

7. Chou R, Shekelle P: Will this patient develop persistent disabling low back pain? JAMA 303:1295-1302, 2010

8. Coté P, Cassidy JD, Carroll L: The epidemiology of neck pain: what we have learned from our population-based studies? J Can Chiropr Assoc 47:284-290, 2003

9. Croft PR, Lewis M, Papageorgiou AC, Thomas E, Jayson MI, MacFarlane GJ, Silman AJ: Risk factors for neck pain: A longitudinal study in the general population. Pain 93:317-325, 2001

10. Currie SR, Wang J: Chronic back pain and major depression in the general Canadian population. Pain 107:60-64, 2004

11. Demyttenaere K, Bonnewyn A, Bruffaerts R, Brugha T, De Graaf R, Alonso J: Comorbid painful physical symptoms and depression: prevalence, work loss, and help seeking. J Affect Disord 92:185-193, 2006

12. Demyttenaere K, Bruffaerts R, Lee S, Posada-Villa J, Kovess V, Angermeyer MC, Levinson D, de Girolamo G, Nakane H, Mneimneh Z, Lara C, de Graaf R, Scott KM, Gureje O, Stein DJ, Haro JM, Bromet EJ, Kessler RC, Alonso J, Von Korff M: Mental disorders among persons with chronic back or neck pain: Results from the World Mental Health Surveys. Pain 129:332-342, 2007

13. Dersh J, Gatchel RJ, Polatin P, Mayer T: Prevalence of psychiatric disorders in patients with chronic work-related musculoskeletal pain disability. J Occup Environ Med 44:459-468, 2002

14. Elman I, Zubieta JK, Borsook D: The missing "P" in psychiatric training: Why is it important to teach pain to psychiatrists? Arch Gen Psychiatry 68:12-20, 2011

15. Fishbain DA, Cutler R, Rosomoff HL, Rosomoff RS: Chronic pain-associated depression: Antecedent or consequence of chronic pain? A review. Clin J Pain 13:116-137, 1997

16. Gureje O, Von Korff M, Kola L, Demyttenaere K, He Y, Villa JP, Lepine JP, Angermeyer MC, Levinson D, Girolamo G, Iwata N, Karam A, Borges GL, Graaf R, Browne MO, Stein DJ, Haro JM, Bromet EJ, Kessler RC, Alonso J: The relationship between multiple pains and mental disorders: Results from the World Mental Health Surveys. Pain 135:82-91, 2008

17. Gureje O, Von Korff M, Simon G, Gater R: Persistent pain and well-being: A World Health Organization study in primary care. JAMA 280:147-152, 1998

18. Harkness J, Pennell BE, Villar A, Gebler N, Aguilar-Gaxiola S, Bilgen I: Translation procedures and translation assessment in the World Mental Health Survey Initiative, in Kessler RC, Üstün TB (eds): The WHO World Mental Health Surveys: Global Perspectives on the Epidemiology of Mental Disorders. New York, Cambridge University Press, 2008, pp 91-113

19. Haro JM, Arbabzadeh-Bouchez SA, Brugha TS, de Girolamo G, Guyer ME, Jin R, Lépine JP, Mazzi F, Reneses B, VilagutSaiz G, Sampson NA, Kessler RC: Concordance of the Composite International Diagnostic Interview version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO World Mental Health Surveys. Int J Methods Psychiatr Res 15:167-180, 2006

20. Harrison A: Assessing patient's pain: Identifying reasons for error. J Adv Nurs 16:1018-1025, 1991

21. Heeringa SG, Wells EJ, Hubbard F, Mneimneh ZN, Chiu WT, Sampson NA, Berglund PA: Sample designs and sampling procedures, in Kessler RC, Üstün TB (eds): The WHO World Mental Health Surveys: Global Perspectives on the Epidemiology of Mental Disorders. New York, Cambridge University Press, 2008, pp 14-32

22. Hestbaek L, Leboeuf-Yde C, Kyvik KO, Vach W, Russell MB, Skadhauge L, Svendsen A, Manniche C: Comorbidity with low back pain: A cross-sectional population-based survey of 12 to 22 year-old. Spine 19:1483-1491, 2004

23. Hestbaek L, Leboeuf-Yde C, Manniche C: Is low back pain part of a general health pattern or is it a separate and distinctive entity? A critical literature review of comorbidity with low back pain. J Manipulative Physiol Ther 26:243-252, 2003

24. Hogg-Johnson S, van der Velde G, Carroll LJ, Holm LW, Cassidy JD, Guzman J, Côté P, Haldeman S, Ammendolia C, Carragee E, Hurwitz E, Nordin M, Peloso P, Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders: The burden and determinants of neck pain in the general population: Results of the bone and joint decade 2000–2010 task force on neck pain and its associated disorders. Spine 33:39-51, 2008

25. Hoy DG, Protani M, De R, Buchbinder R: The epidemiology of neck pain. Best Pract Res Clin Rheumatol 24:783-792, 2010

26. Jamison RN, Raymond SA, Slawsby EA, McHugo GJ, Baird JC: Pain assessment in patients with low back pain: Comparison of weekly recall and momentary electronic data. J Pain 7:192-199, 2006

27. Kessler RC, Üstün TB: The World Mental Health (WMH) survey initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). Int J Methods Psychiatr Res 13:9-121, 2004

28. Kessler RC, Üstün TB: The WHO World Mental Health Surveys: Global Perspectives on the Epidemiology of Mental Disorders. New York, Cambridge University Press, 2008

29. Magni G, Moreschi C, Rigatti-Luchini S, Mesrkey H: Prospective study on the relationship between depressive symptoms and chronic musculoskeletal pain. Pain 56:289-297, 1994

30. Makela M, Heliovaraa M, Sievers K, Impivaara O, Knekt P, Aromaa A: Prevalence, determinants, and consequences of neck pain in Finland. Am J Epidemiol 134:1356-1367, 1991

31. Melloh M, Elfering A, Egli Presland C, Röder C, Hendrick P, Darlow B, Theis JC: Predicting the transition from acute to persistent low back pain. Occup Med 61:127-131, 2001

32. Meyer T, Cooper J, Raspe H: Disabling low back pain and depressive symptoms in the community-dwelling elderly: A prospective study. Spine 32:2380-2386, 2007

33. National Center for Health Statistics: Evaluation of National Health Interview Survey diagnostic reporting. Vital Health Stat 120:1-116, 1994

34. Nunes SO, Vargas HO, Prado E, Barbosa DS, de Melo LP, Moylan S, Dodd S, Berk M: The shared role of oxidative stress and inflammation in major depressive disorder and nicotine dependence. Neurosci Biobehav Rev 8:1336-1345, 2013

35. Palmer KT, Walsh K, Bendall H, Cooper C, Coggon D: Back pain in Britain: Comparison of two prevalence surveys at an interval of 10 years. Bristish Med J 320:1577-1578, 2000

36. Pennell BE, Mneimneh Z, Bowers A, Chardoul S, Wells JE, Viana MC, Dinkelmann K, Gebler N, Florescu S, He Y, Huang Y, Tomov T, Vilagut-Saiz G: Implementation of the World Mental Health Surveys, in Kessler RC, Üstün TB (eds): The WHO World Mental Health Surveys: Global Perspectives on the Epidemiology of Mental Disorders. New York, Cambridge University Press, 2008, pp 33-57

37. Picavet HS, Schouten JS: Musculoskeletal pain the Netherlands: Prevalences, consequences and risk groups. The DMC (3)-study. Pain 102:167-178, 2003

38. Pincus T, Burton AK, Vogel S, Field AP: A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. Spine 27:109-120, 2002

39. Rethorst CD, Bernstein I, Trivedi MH: Inflammation, obesity, and metabolic syndrome in depression: Analysis of the 2009–2010 National Health and Nutrition Examination Survey (NHANES). J Clin Psychiatry 75:1428-1432, 2014

40. Rothman KJ: No adjustments are needed for multiple comparisons. Epidemiology 1:43-46, 1990

41. Santos-Eggiman B, Wietlisbach V, Rickenbach M, Paccaud F, Gutzwiller F: One-year prevalence of low back pain in two Swiss regions: Estimates from the population participating in the 1992–1993 MONICA project. Spine 25:2473-2479, 2000

42. Scott KM, Bruffaerts R, Tsang A, Ormel J, Alonso J, Angermeyer MC, Benjet C, Bromet E, de Girolamo G, de Graaf R, Gasquet I, Gureje O, Haro JM, He Y, Kessler RC, Levinson D, Mneimneh ZN, Oakley Browne MA, Posada-Villa J, Stein DJ, Takeshima T, Von Korff M: Depression-anxiety relationships with chronic physical conditions: Results from the World Mental Health Surveys. J Affect Disord 103:113-120, 2007

43. Scott KM, Von Korff M, Alonso J, Angermeyer MC, Bromet E, Fayyad J, de Girolamo G, Demyttenaere K, Gasquet I, Gureje O, Haro JM, He Y, Kessler RC, Levinson D, Medina Mora ME, Browne MO, Ormel J, Posada Villa J, Watanable M, Williams D: Mental-physical co-morbidity and its

relationship with disability: Results from the World Mental Health Surveys. Psychol Med 39:33-43, 2009

44. Shah BV: Linearization methods of variance estimation, in Armitage P, Colton T (eds): Encyclopedia of Biostatistics. Chichester, John Wiley and Sons, 1998, pp 2276-2279

45. Sharp J, Keefe B: Psychiatry in chronic pain: A review and update. 2006 Available at: http://focus.psychiatryonline.org/article.aspx?articleID=50863. Accessed December 2, 2014

46. Simon GE, Von Korff M: Recall of psychiatric history in cross-sectional surveys: Implications for epidemiological research. Epidemiol Rev 17:221-227, 1995

47. Singer JD, Willett JB: It's about time: Using discrete-time survival analysis to study duration and the timing of events. J Educ Stat 18:155-195, 1993

48. Solomon P: Congruence between health professionals' and patients' pain ratings: A review of the literature. Scand J Caring Sci 15:174-180, 2001

49. Research Triangle Institute: SUDAAN: Software for the Statistical Analysis of Correlated Data. Durham, NC, Research Triangle Institute, 1999

50. Van Reedt Dortland AK, Vreeburg SA, Giltay EJ, Licht CM, Vogelzangs N, Van Veen T, de Geus EJ, Penninx BW, Zitman FG: The impact of stress systems and lifestyle on dyslipidemia and obesity in anxiety and depression. Psychoneuroendocrinology 38:209-218, 2013

51. Vassend O, Skrondal A: The role of negative affectivity in self-assessment of health. J Health Psychol 4:465-482, 1999

52. Vassilaki M, Hurwitz EL: Perspectives on pain in the low back and neck: Global burden, epidemiology, and management. Hawaii J Med Public Health 73:122-126, 2014

53. Von Korff MR, Crane P, Lane M, Miglioretti DL, Simon G, Saunders K, Stang P, Brandenburg N, Kessler R: Chronic spinal pain and physical-mental comorbidity in the United States: Results from the national comorbidity survey replication. Pain 115:331-339, 2005

54. Research Triangle Institute: Von Korff MR, Scott KM, Gureje O (eds): Global Perspectives on Mental-Physical Comorbidity in the WHO World Mental Health Surveys. New York, Cambridge University Press, 2009

55. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, Shibuya K, Salomon JA, Abdalla S, Aboyans V, Abraham J, Ackerman I, Aggarwal R, Ahn SY, Ali MK, Alvarado M, Anderson HR, Anderson LM, Andrews KG, Atkinson C, Baddour LM, Bahalim AN, Barker-Collo S, Barrero LH, Bartels DH, Basáñez MG, Baxter A, Bell ML, Benjamin EJ, Bennett D, Bernabé E, Bhalla K, Bhandari B, Bikbov B, Bin Abdulhak A, Birbeck G, Black JA, Blencowe H, Blore JD, Blyth F, Bolliger I, Bonaventure A, Boufous S, Bourne R, Boussinesq M, Braithwaite T, Brayne C, Bridgett L, Brooker S, Brooks P, Brugha TS, Bryan-Hancock C, Bucello C, Buchbinder R, Buckle G, Budke CM, Burch M, Burney P, Burstein R, Calabria B, Campbell B, Canter CE, Carabin H, Carapetis J, Carmona L, Cella C, Charlson F, Chen H, Cheng AT, Chou D, Chugh SS, Coffeng LE, Colan SD, Colquhoun S, Colson KE, Condon J, Connor MD, Cooper LT, Corriere M, Cortinovis M, de Vaccaro KC, Couser W, Cowie BC, Criqui MH, Cross M, Dabhadkar KC, Dahiya M, Dahodwala N, Damsere-Derry J, Danaei G, Davis A, De Leo D, Degenhardt L, Dellavalle R, Delossantos A, Denenberg J, Derrett S, Des Jarlais DC, Dharmaratne SD, Dherani M, Diaz-Torne C, Dolk H, Dorsey ER, Driscoll T, Duber H, Ebel B, Edmond K, Elbaz A, Ali SE, Erskine H, Erwin PJ, Espindola P, Ewoigbokhan SE, Farzadfar F, Feigin V, Felson DT, Ferrari A, Ferri CP, Fèvre EM, Finucane MM, Flaxman S, Flood L, Foreman K, Forouzanfar MH, Fowkes FG, Franklin R, Fransen M, Freeman MK, Gabbe BJ, Gabriel SE, Gakidou E, Ganatra HA, Garcia B, Gaspari F, Gillum RF, Gmel G, Gosselin R, Grainger R, Groeger J, Guillemin F, Gunnell D, Gupta R, Haagsma J, Hagan H, Halasa YA, Hall W, Haring D, Haro JM, Harrison JE, Havmoeller R, Hay RJ, Higashi H, Hill C, Hoen B, Hoffman H, Hotez PJ, Hoy D, Huang JJ, Ibeanusi SE, Jacobsen KH, James SL, Jarvis D, Jasrasaria R, Jayaraman S, Johns N, Jonas JB, Karthikeyan G, Kassebaum N, Kawakami N, Keren A, Khoo JP, King CH, Knowlton LM, Kobusingye O, Koranteng A, Krishnamurthi R, Lalloo R, Laslett LL, Lathlean T, Leasher JL, Lee YY, Leigh J, Lim SS, Limb E, Lin JK, Lipnick M, Lipshultz SE, Liu W, Loane M, Ohno SL, Lyons R, Ma J, Mabweijano J, MacIntyre MF, Malekzadeh R, Mallinger L, Manivannan S, Marcenes W, March L, Margolis DJ, Marks GB, Marks R, Matsumori A, Matzopoulos R, Mayosi BM, McAnulty JH, McDermott MM, McGill N, McGrath J, Medina-Mora ME, Meltzer M, Mensah GA, Merriman TR, Meyer AC, Miglioli V, Miller M, Miller TR, Mitchell PB, Mocumbi AO, Moffitt TE, Mokdad AA, Monasta L, Montico M, Moradi-Lakeh M, Moran A, Morawska L, Mori R, Murdoch ME, Mwaniki MK, Naidoo K, Nair MN, Naldi L, Narayan KM, Nelson PK, Nelson RG, Nevitt MC, Newton CR, Nolte S, Norman P, Norman R, O'Donnell M, O'Hanlon S, Olives C, Omer SB, Ortblad K, Osborne R, Ozgediz D, Page A, Pahari B, Pandian JD, Rivero AP, Patten SB, Pearce N, Padilla RP, Perez-Ruiz F, Perico N, Pesudovs K, Phillips D, Phillips MR, Pierce K, Pion S, Polanczyk GV, Polinder S, Pope CA 3rd, Popova S, Porrini E, Pourmalek F, Prince M, Pullan RL, Ramaiah KD, Ranganathan D, Razavi H, Regan M, Rehm JT, Rein DB, Remuzzi G, Richardson K, Rivara FP, Roberts T, Robinson C, De Leòn FR, Ronfani L, Room R, Rosenfeld LC, Rushton L, Sacco RL, Saha S, Sampson U, Sanchez-Riera L, Sanman E, Schwebel DC, Scott JG, Segui-Gomez M, Shahraz S, Shepard DS, Shin H, Shivakoti R, Singh D, Singh GM, Singh JA, Singleton J, Sleet DA, Sliwa K, Smith E, Smith JL, Stapelberg NJ, Steer A, Steiner T, Stolk WA, Stovner LJ, Sudfeld C, Syed S, Tamburlini G, Tavakkoli M, Taylor HR, Taylor JA, Taylor WJ, Thomas B, Thomson WM, Thurston GD, Tleyjeh IM, Tonelli M, Towbin JA, Truelsen T, Tsilimbaris MK, Ubeda C, Undurraga EA, van der Werf MJ, van Os J, Vavilala MS, Venketasubramanian N, Wang M, Wang W, Watt K, Weatherall DJ, Weinstock MA, Weintraub R, Weisskopf MG, Weissman MM, White RA, Whiteford H, Wiersma ST, Wilkinson JD, Williams HC, Williams SR, Witt E, Wolfe F, Woolf AD, Wulf S, Yeh PH, Zaidi AK, Zheng ZJ, Zonies D, Lopez AD, Murray CJ, AlMazroa MA, Memish ZA: Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. Lancet 380:2163-2196, 2012. Erratum in: Lancet 381:628 AlMazroa, Mohammad A [added]; Memish, Ziad A [added], 2013

56. Wells JE, Horwood LJ: How accurate is recall of key symptoms of depression? A comparison of recall and longitudinal reports. Psychol Med 34:1001-1011, 2004